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DEFINITIONS OF BODY DIMENSIONS USED IN DESCRIBING TUNAS

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FISHERY BULLETIN 47

From Fishery Bulletin of the Fish and Wildlife Service

VOLUME 51

UNITED STATES DEPARTMENT OF THE INTERIOR, J. A. Krug, *Secretary*

FISH AND WILDLIFE SERVICE • Albert M. Day, *Director*

UNITED STATES GOVERNMENT PRINTING OFFICE • WASHINGTO

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EFINITIONS OF BODY DIMENSIONS USED IN DESCRIBING TUNAS

ortunities have recently been afforded us to biological data on several species of tunas in s regions of the Pacific Ocean. The problem ether there exists in each species one or more ations has been of major interest. It is im- t to know for any commercially utilized s, and especially for pelagic species of wide ution such as the tunas, whether exploitation y point in their range bears upon the whole or whether exploitation at one point will not the stock at another point. The classical d of distinguishing subpopulations in syste- and fisheries work is that of comparing series ristic counts and morphometric characteristics samples taken at different localities through- e range of the species. Due to the improba- of one or two individuals being able to examine quate series of tunas over a broad area within a able period of time, our data are being made ble as soon as possible, so they may be used her workers. One such report has already red (Schaefer 1948). In order to facilitate the our data, the methods used are defined here. of them have been given by Godsil and Byers , but some have been modified by Schaefer , and additional ones will be used later. It worth while that, for convenience, they be set n one place.

inally, a comprehensive list of meristic and ometric characters was drawn up, but field ence demonstrated the unwieldiness of such ensive list. The characters used were selected h a view to choosing those that would be likely w possible differences; (2) because of facility nting or measuring; and (3) because of their previous workers. There is, of course, no nce that these particular characters will be of in identifying discrete populations, if such In all probability the list will have to be ed and expanded from time to time.

ollecting our data, an effort has been made to e fish in the entire size range available at e locality. This permits the various body tions to be expressed as the regression of one dimension on another, such as the regression of head length on total length. The necessity for the comparison of regressions rather than ratios arises from the fact that the different parts of the body grow at different rates, as has been shown for *Neothunnus macropterus* by Schaefer (1948) and for *Thunnus thynnus* of the Atlantic by Frade (1931a). Most of the morphometric data on tunas both from the Atlantic-Mediterranean region (Anon. 1933; Frade 1929, 1931a, 1931b; Heldt 1928, 1931) and from the Pacific (Godsil and Byers 1944) have been in the form of ratios of one dimension to another. These data are of small value for comparing the fish from one region with those of another, because of the differential growth rate of different parts of the body. It is important that researchers in different parts of the world publish either the original measurements or the statistics describing the regressions with the ranges of size to which they apply, or, preferably, both.

The specimens examined by us were all fresh-caught. It is desirable that measurements of fresh-caught fish form the basis of comparisons until such time as the effects of freezing or chemical preservation on the body proportions have been determined to have constant effects and those effects are firmly established. The natural variability of most dimensions is relatively small (Schaefer 1948) so that the effect of preservation on differential shrinkage or expansion of different body parts might lead to spurious results if samples of preserved fish from one region were compared with samples of fresh fish from another, or if samples of fish from two different regions had undergone different preservative treatment. Of course, this does not apply where countable characters rather than measurements are concerned.

The measurements described are all made in metric units with calipers (of the type mentioned by Godsil and Byers 1944) or dividers, depending upon the size of the fish and the distance to be measured. All distances are straight line. The tip of the fixed arm of the calipers (or one point of the dividers) is applied to the first point mentioned and the tip of the sliding arm of the calipers (or the other point of the dividers)

is applied to the second point mentioned. Where a choice of sides is involved, all measurements and counts are made on the left side of the fish.

Total length.—The distance from the tip of the snout (most anterior point on upper jaw), with jaws closed, to the cartilaginous median part of the caudal fork (seating the sliding arm of the caliper firmly and thus depressing the small fleshy flap extending posteriorly).

second dorsal. The insertion of the second d is not so clearly defined as the insertion of the dorsal, particularly on larger fish, but is the i section of the anterior margin of the second do when the fin is held erect, with the contour o back. When the second dorsal is raised, the d mined point should be marked with thumbna scalpel.

Snout to insertion anal.—The distance

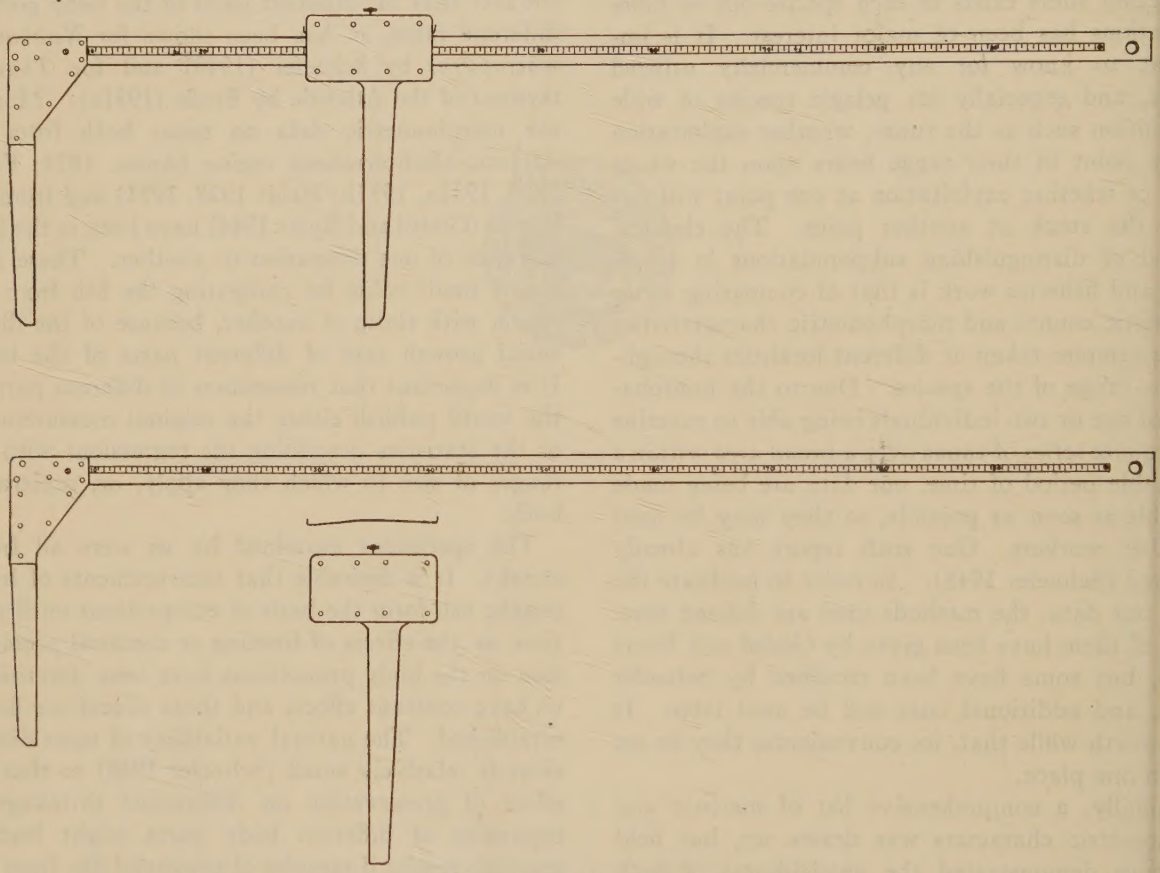

FIGURE 1.—Calipers used in measuring tunas; above, assembled; below, unassembled.

Head length.—The distance from the tip of the snout to the most posterior point on the margin of the subopercle (depressing the fleshy flap extending posteriorly).

Snout to insertion first dorsal.—The distance from the tip of the snout to the insertion of the first dorsal. The insertion of the first dorsal is the intersection of the anterior margin of the first dorsal spine, when the fin is held erect, with the contour of the back. This point is identical with the most anterior point of the first dorsal fin slot.

Snout to insertion second dorsal.—The distance from the tip of the snout to insertion of the

the tip of the snout to the insertion of the The insertion of the anal is determined in the manner as the insertion of the second dorsal.

Snout to insertion ventral.—The dis from the tip of the snout to the insertion of th tral. The insertion of the ventral is the inters of the anterior margin of the ventral, when the extended, with the contour of the body.

Greatest depth.—The greatest vertical di between the dorsal and ventral contours. measurement is taken from the dorsal body co to the ventral body contour, with the first dor depressed in its slot. It is oriented by refere

orsal spine, the insertion of which is at or near- ne upper end of the vertical. Dorsal spines are ted posteriorly, the most anterior spine being irst.

ength pectoral.—The distance from the inser- of the pectoral to the most posterior point, taken the pectoral fin extended posteriorly and sed to the side. The insertion of the pectoral is ntersection of its dorsal margin with the body.

ctoral insertion to insertion first dorsal.— distance from the insertion of the pectoral fin to nsertion of the first dorsal.

ength base first dorsal.—The distance from nsertion of the first dorsal to the insertion of the d dorsal.

ength base second dorsal.—The distance the insertion of the second dorsal to the inter- on of the posterior margin of the second dorsal the contour of the back. Note that this in- s any finlet that is attached to the second dorsal. use of the difficulty in determining whether or finlet is "attached" (i. e., contiguous with the d dorsal) it is not a very good character.

read caudal.—The distance between the -posterior extremity of the caudal and the o-posterior extremity of the caudal. This urement is accurate only if the caudal extremi- are not frayed, the fish has not been handled sively by the tail, and the fish has not been out e water long enough for the caudal to dry (and bly shrink).

ngth longest dorsal spine.—The distance the insertion of the longest spine to its distal The insertion of the spine, with the fin held is the intersection of its anterior margin with ontour of the back.

ngth first dorsal spine.—The distance from sertion of the first dorsal spine to its distal end.

ngth second dorsal.—The distance from the ion of the second dorsal to its distal end, with n in a normal position. Note that this fin is extended in a long filament, especially in large *unnus*, and care should be taken to notice if xtension is frayed.

ngth anal.—The distance from the insertion anal fin to its distal end, with the fin in a l position. Remarks under "length second " apply here.

ngth longest dorsal finlet.—The distance he insertion of the longest dorsal finlet to the end of its posterior filament. The insertion of the finlet is the intersection of its anterior margin with the contour of the body. Dorsal finlets are identified by number. They are numbered anteriorly, the most posterior one being the first.

Diameter of iris.—The greatest diameter measured to the margin of the yellow iris and the adjoining black tissue. This is generally not on a line parallel to the median line of the body.

Length maxillary.—The distance from the tip of the snout to the posterior end of the maxillary.

Least depth caudal peduncle.—The least vertical distance between the dorsal and ventral contours of the caudal peduncle.

Greatest width caudal peduncle at keels.—The greatest horizontal distance between the lateral contours including the keels. Note that the keels may be broken or shrunken (due to drying).

Number of first dorsal spines.—The total number of spines discernible with the first dorsal held erect and with no dissection. The most posterior spine may be completely subcutaneous and is then not counted.

Number of dorsal finlets.—The number of finlets following the second dorsal. The most posterior one is counted as the first, and finlets attached to the second dorsal are counted separately. For example, 9=9 free finlets; 8+1=8 free finlets plus 1 finlet attached to the second dorsal. It is often difficult to decide whether or not a finlet is attached, and consequently this character may be of little use.

Number of anal finlets.—The number of finlets following the anal fin. Counted in the same manner as the dorsal finlets.

Number of gill rakers.—The number of anterior rakers on the most anterior gill arch on the left side of the fish (some species also have posterior rakers on this same arch). The counts of the rakers on the two arms of the arch are kept separate. For example, 10+20=30 gill rakers with 10 on the upper arm and 20 on the lower. The counts include all rakers that can be seen or felt with a dissecting needle. We have encountered no difficulty in assigning rakers near the angle of the arch to one arm or the other.

Sex.—Determined by inspection. Very immature males and females may be difficult to distinguish. Ovaries, which are tubular, may often roll between the fingers, while testes, which are solid, will turn over. The testes of ripening or ripe males are

enlarged, solid, white bodies, not round in cross section. The ovaries of ripening or ripe females are enlarged, turgid, pink or yellow-orange bodies, round in cross section. Ova may often be distinguishable with the naked eye. The testes of spawned-out males are less turgid, tougher, and pinker than those not spawned, and are difficult or impossible to distinguish from maturing testes in early stages. The ovaries of spawned-out females are hollow, more or less flabby, sac-like tubes.

Weight.—This has been determined in pounds on spring balances. Metric units would be more desirable, and experience has shown that a counterpoise style of balance, such as Chatillon No. 160, is more satisfactory, since the calibration of a spring balance is subject to change due to corrosion.

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